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An Evaluation of Strategies to Control Noise from Refuse Collection Vehicles

Metropolitan Washington Council of Governments
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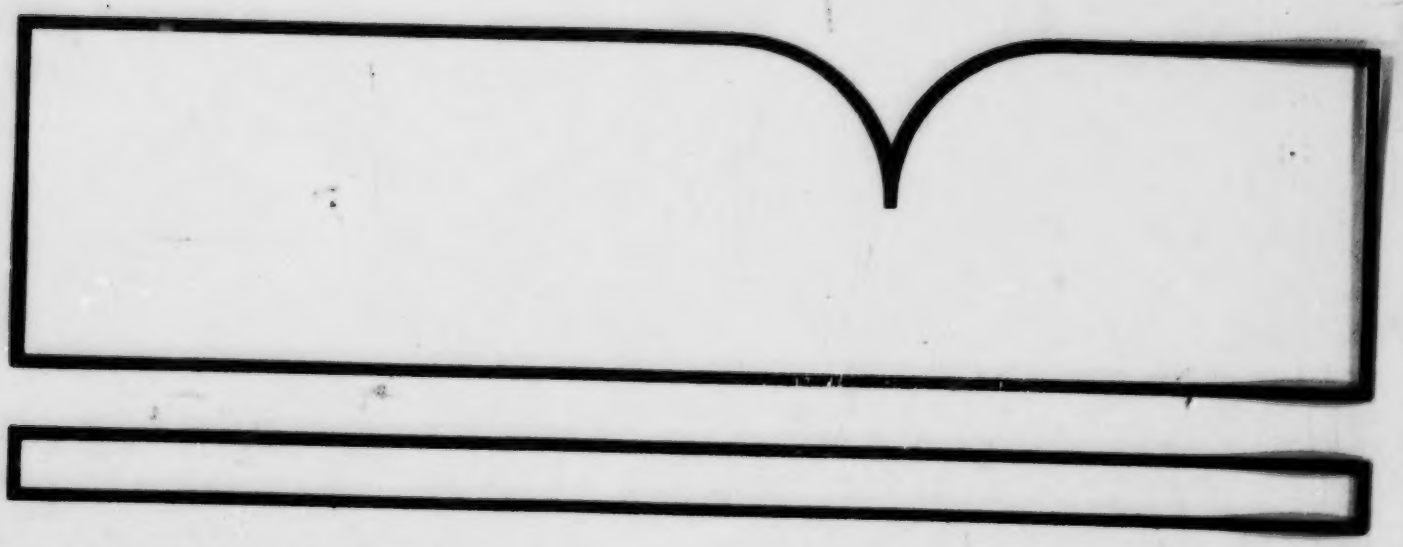

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AN EVALUATION OF STRATEGIES TO CONTROL NOISE FROM REFUSE COLLECTION VEHICLES

August 1981

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Noise Abatement and Control
Washington, D.C. 20460

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16. ABSTRACT

This report investigated four potential noise control approaches to the control of noise from refuse collection vehicles. These included: (1) the potential impact of a legislative alternative requiring stationary compactors for all new high-rise developments; (2) the effect of a collection curfew; (3) the incorporation of noise into an annual inspection program and (4) the impact of taking no local action and allowing federal regulations to serve as the only control. The incorporation of noise into an annual refuse collection vehicle inspection program is, undoubtedly, the preferred mechanism for control. It provides a mechanism for routine monitoring and isolation of particularly noise vehicles. As this study was performed in Prince George's County, Maryland, where high-rise development is minimal, further consideration for the first alternative was not given.

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Foreword

In October, 1976, the U.S. Environmental Protection Agency contracted with the Metropolitan Washington Council of Governments to develop a plan to evaluate specific noise control strategies in a major metropolitan area. During the performance of that contract, staff from COG and six of its area jurisdictions, identified noise source targets for study and developed a series of potential strategies for evaluation. The overall plan was then presented to EPA for their consideration for funding of the implementation phase.

The contract for the implementation phase of the study was awarded in September, 1977. Specific work elements included the development of two educational modules and the investigation of control strategies for grain dryers, air conditioning/refrigeration equipment, minibikes and refuse collection vehicles. For each specific noise source to be studied, a jurisdiction within the metropolitan Washington area was selected to work with COG in the investigation.

This report on the noise from refuse collection vehicles is one of a series describing each of the activities undertaken. The format for each report details the strategies evaluated and assesses the experiences encountered. Each is designed to provide guidance for other state and local noise programs faced with similar noise problems. Hence, emphasis is placed on the practical aspects of attempting to implement innovative approaches.

This investigation of control strategies for refuse collection vehicles was completed by the noise staffs from the Directorate of Environmental Health in Prince George's County, Maryland, and the Metropolitan Washington Council of Governments. A brief summary of the Prince George's County overall noise program is presented in Appendix I. The four control strategies investigated were: (1) the potential impact of a legislative alternative requiring stationary compactors for all new highrise developments, (2) the effect of a collection curfew, (3) the incorporation of noise into an annual inspection program and (4) the impact of taking no local action and allowing federal regulations to serve as the only control.

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I. Analysis of the Impact of Refuse Collection Noise in Prince George's County:

Initially a survey of the fleet of refuse collection vehicles in Prince George's County was conducted. The data were gathered from information filed with the Division of Solid Waste and Noise Control at the time of the 1977 annual inspection. It was found there were approximately 740 refuse collection vehicles operating in the County. Of these, 48.7% were rear packers; 35.8% were open bed; 7.4% were roll-offs; 7.02% were front-end loaders and less than 1% were either panel or side loaders. In terms of age, 4% were over 20 years old; 17% were 10-20 years old and 82% were less than 10 years old.

A review of noise complaint data indicated that in a period of approximately four years, complaints concerning refuse collection had constituted one of the more frequent types of complaints. Typically, these complaints had focused on collection practices rather than vehicular or compactor noise. In the few cases where hours of operation had been a concern, staff had been successful in obtaining voluntary changes in schedule.

In the preparation of the Background Document for the proposed noise emission regulations for refuse collection vehicles, a formula for the determination of Equivalent Noise Impact (ENI) was presented.

$$ENI_i = (FI_i)(P_i)$$

WHERE FI_i = the fractional impact which is derived by $.05(L_{dni} - 55)$. Note: To obtain L_{dni}, use Exhibit 5 - c, p. 5 - 71 in the EPA document. If L_{dn} is less than 55, the FI is 0.

AND (P_i) = the population in a particular land use category. (In the case of Prince George's County, this information was obtained from Census Bureau Reports and Cooperative Forecasting Data.)

Based on the most currently available land use and population data for the County, it was determined that types of housing units were as follows:

Suburban Single Family Detached:	55.1%
Suburban Duplexes:	1.4
Urban Row Apartments	2.5
Dense Urban Apartments	36.4
Very Dense Urban Apartments	4.6
	100%

Population by land use was then determined as follows:

Suburban Single Family Detached:	372,336
Suburban Duplexes:	9,546
Urban Row Apartments	17,122
Dense Urban Apartments	245,800
Very Dense Urban Apartments	30,696

Using the EPA document 550/9-77-204, Exhibit 5-C, L_{dn} values for Option 7, which corresponds to the proposed federal regulations, were obtained.

Land Use	L_{dn}
Suburban Single Family Detached:	44.790
Suburban Duplexes:	50.679
Urban Row Apartments:	61.870
Dense Urban Apartments:	70.369
Very Dense Urban Apartments:	74.679

Then the formulae $FI_i = (.05)(L_{dni} - 55)$ and $ENI_i = (FI_i)(P_i)$ were used to arrive at the number of persons currently experiencing general annoyance from refuse collection vehicles in Prince George's County, Maryland.

Land Use	FI_i	ENI_i
Suburban Single Family Detached:	0	0
Suburban Duplexes:	0	0
Urban Row Apartments:	.3435	5,881.4
Dense Urban Apartments:	.76845	188,885.0
Very Dense Urban Apartments:	.98395	30,203.3
Total		224,969.7 or 224,970

Thus, it was determined that approximately 224,970 residents are presently experiencing general annoyance.

II. Analysis of the Potential Impact of a Legislative Alternative Requiring Stationary Compactors for All New Highrise Developments:

One element of the study of noise from refuse collection vehicles was to explore the effect of legislation which would require the use of stationary refuse compactors at highrise apartment complexes in order to reduce the noise generated by refuse collection vehicles equipped with compacting units. It was anticipated that a reduction in noise (both in terms of levels and exposure) would result from less frequent refuse collection vehicle trips to the site. However, evaluation of this hypothesis resulted in the determination that this approach was not practical in Prince George's County at this time.

Initially, letters were sent to four of the largest manufacturers of refuse collection and processing equipment in an effort to obtain the names of the closest regional distributor of each company's equipment. The four companies were: (1) McClain Industries, Inc., (2) Marathon Equipment Company, (3) Heil Company and (4) Dempster Dumpster Systems. Marathon and Dempster responded to this initial contact and, of the two, only Dempster provided us with the needed information. A copy of the letter and the one response received is shown in Appendix II. The staff received a reply which contained information on Dempster's full-line of stationary refuse compactors in terms of overall capacity, size and costs. Equipment ratings for such things as noise and energy consumption were not available, therefore, it was deemed necessary to visit a site where

a Dempster stationary refuse compactor had been installed and was in operation, thus, obtaining noise measurement data firsthand.

Two Dempster "Wastepactor" stationary refuse compactors (Model WP-157-D) had been installed by the University of Maryland in a dormitory complex in College Park, Maryland. A staff member visited the site and, accompanied by an employee of the University's Department of General Services, made noise measurements of the equipment in operation. Two identical units were housed in two identical trash rooms at each end of a large highrise dormitory (actually two dorms linked together by a common lobby). A trash chute from the upper floors emptied directly into the compactor unit in each room. The two rooms had smooth concrete floors and ceilings and concrete block walls; the ceilings were about ten feet high. Both rooms were situated in the basement of ground floor of the building, adjacent to non-living spaces on each site and below bathrooms on the floor above.

Each unit was run through a complete compacting cycle lasting approximately 4-5 minutes, while four noise measurements were recorded at different locations in the room. The four measurements were: (1) directly over the chute opening, (2) directly over the motor, (3) approximately six feet to one side of the compactor and (4) peak impact at the same location. For the first compactor, the four measurements were: 85 dBA, 85 dBA, 79 dBA and 85 dBA, respectively. The second compactor measured: 85 dBA, 89 dBA, 77 dBA and 85 dBA. The differences in measured sound levels were

due to subtle differences in location within the rooms of each compactor. The compactor motor in the second room was located in a "niche" in the wall which created a greater reverberant effect than if located closer to the middle of the room as the first one was. Outside of the rooms, the sound was negligible and acoustical treatment within the rooms could have absorbed much of the sound.

The refuse is compacted into heavy-duty plastic bags, which are then carted out to the service entrance where they are loaded onto the collection vehicle. The compactors are run once a day about 11:00 a.m. and the truck arrives at noon. With this type of operation, no complaints have been received from residents of the dorm about the stationary compactors, however, there have been complaints about the collection vehicles which, occasionally, must run their truck-mounted compactors at the site.

In talking with General Services personnel at the University of Maryland, it was discovered that noise was not one of the factors considered in purchasing and installing the stationary refuse compactors in the dormitory. The primary considerations were benefits such as a reduction in person-hours necessary to collect the trash, reduction in trash volume for storage purposes and a cleaner operation. It is still necessary to collect the trash daily to avoid problems with odors or vectors (rats, flies). Therefore, noise is still somewhat of a problem due to the necessity for conventional pick-up and hauling procedures operated in close proximity to the building. The nature of the noise complaints at the University

followed the trend of complaints elsewhere in the County. That is, complaints focus on noise from collectors' conversations and the handling of trash containers, rather, than from compactor noise itself.

The University representative stated that the cost of the stationary refuse compactors was also an obvious consideration. Once installed, the reduced operating costs were judged to more than offset the burden of the initial capital outlay, which amounted to over $3,000 per unit, installed. The operational costs associated with collection were reduced by approximately fifty percent after the installation of the compactors. This was due to the reduction in person-hours needed to collect the refuse, and operate/maintain the trash rooms. Disposal costs were not significantly affected since the University collects the refuse in its own vehicles and pays a $6.00 per ton tipping fee at the landfill. As previously noted, daily collection and disposal is still necessary for hygiene purposes.

In collecting its own refuse, the University is in a unique situation; private apartment complexes and condominiums must rely on commercial collection. Collection frequency would not be reduced by compactor installation. These collection rates vary from place to place within the County. Virtually all of the incorporated municipalities, however, provide their own refuse collection services and set their own rates. Municipal collection accounts for approximately one-third of the total volume of trash collected in the County.

The other two-thirds is collected by commercial haulers which are contracted by the County for this purpose. The rates average $8.00 per month for back-door service and $5.00 per month for curb service. These are per household figures.

The stationary refuse compactor concept is practical only in highrise apartments or condominium buildings which are large enough to employ a trash chute system leading to a large trash room in the basement or on the ground floor. Presently, in Prince George's County, there are only three highrise dwellings with 500-1,000 occupants, and seven with 300-500 occupants. Of these ten, four already use a stationary refuse compactor. In theory, a legislative requirement for new construction offers the greatest potential for the development of this concept. There are presently only a few large highrises in the County and recent projections for development do not indicate a trend toward more highrises. In fact, the trend is significantly toward increased single family dwellings.

The process involved in the development of the legislative alternative is very laborious. Staff would first be required to prepare a study which documents the need for the regulation. Then, the regulation would be drafted and subjected to several levels of internal review with final approval delegated to the County Health Officer. From the County Health Officer, the draft legislation would be forwarded for legal review.

After this review, staff would, either, need to find an interested council person to sponsor the proposed legislation, or forward it to both the County Executive and the Chairman of the Council. It would then become a bill introduced by either the Executive or Legislative Branch. After review by the Economic Affairs Committee, all applicable departments would be given an opportunity to comment. These departments would include: Public Works, Economic, Park and Planning and Licenses and Permits. The bill would then go to the County Council where it would be open for public comment as well. If passed, it would then be signed by the Executive and become law. The time frame required ranges from three months to several years.

The noise staff in Prince George's County has been working several years to develop a comprehensive noise ordinance to move through the procedure delineated above and it is still in the early stages of internal review. An administrative decision has been made not to move forward for at least another year. In all probability, an attempt to introduce a legislative requirement for compactors would further delay the progress of the comprehensive ordinance. Any adverse publicity would have a significant detrimental effect on the future of the ordinance. Moreover, given the facts that increased highrise development is not planned and noise complaints focus on collection practices, which would not be altered by compactor installation, the legislative alternative would not result in material noise reduction benefits. Conversely, in other areas where extensive highrise development is planned, there might be merit in this approach.

III. Analysis of the Effect of a Collection Curfew in the County:

Approximately one-third of the refuse collection vehicles are owned by incorporated municipalities. A survey of twenty-four of the municipalities indicated that only four had early morning pick-ups; the remainder initiated service at 7:00 a.m. None indicated receiving complaints regarding the hours of pick-up.

The remaining two-thirds of the refuse collection vehicles are owned by private haulers contracted by the County. A survey of thirty-seven of the haulers revealed that approximately twenty percent had evening collections and one-half had early morning pick-up services, however, the routings were generally such that there was little impact on residential areas. In those few instances where noise complaints have been received, the noise staff has been very successful in talking to the haulers and getting route changes implemented.

The mechanism for the establishment of a curfew system in the County is quite simple. It would be made a part of the Public Works contract because the County has the authority to specify collection times. There is, however, no need to establish a curfew system in the County at this time. The noise staff has been pleased with the voluntary cooperation of the haulers, recognizing that a mandated curfew system has the potential to create more problems than it solves. One concern is enforcement since staff would be needed at times when they are not necessarily available; secondly, the landfills are not lighted. Curfews would condense the operational

hours and require additional staffing to meet the increased usage during available hours. Also, collection personnel would probably be inclined to work faster, enabling them to finish at their pre-curfew hour. Faster work would, undoubtedly, translate into increased slamming of dumpsters and trash cans which is already the major source of complaints. Another factor which could easily be overlooked and which we discovered through our interviews was that many people favor early collection hours because family members work and want to replace trash cans before departure.

Although the curfew alternative is not viewed as a necessary control mechanism in Prince George's County, other jurisdictions may find it an effective control approach. In situations where complaints focus on evening and early morning collection, it would certainly be effective provided adequate staff were available for enforcement, however, resistance from haulers should be anticipated. Another jurisdiction in the metropolitan Washington area recently encountered severe problems when the curfew was enforced; haulers in the jurisdiction refused to collect the refuse at any hour. If a curfew is deemed necessary, it should be limited to residential areas and well-publicized to the haulers prior to any enforcement actions. The adverse publicity associated with the strike did little to foster the image of noise control programs in our area.

IV. Exploration of Incorporation of Noise Into Annual Inspection Program:

On August 11, 1967, a Solid Waste Ordinance was adopted by the Board of County Commissioners of Prince George's County. The Ordinance requires that all refuse collection vehicles operating in the County must be licensed by the Department of Public Works. The vehicles may only be licensed if they pass an annual inspection by the County Health Officer and are not found in violation of the Ordinance at any time during the year.

The annual inspection is conducted by the Directorate of Environmental Health in the spring at the major sanitary landfills in the County. Each driver is required to produce the vehicle's registration card, and to provide any other information required to complete the inspection form. The form is shown in Appendix III. The truck is then thoroughly inspected according to a specific set of requirements which are as follows:

(1) Trucks must have a Maryland license plate. Temporary Maryland plates are acceptable. Trucks may have other plates in addition to the Maryland plate.

(2) Open type trucks (stake body, dump, metal body) must have a cover that completely covers the top and rear openings of the truck. The fit of the cover will be checked. Tailgates must fit snugly. There must be no holes in the body or bed.

(3) Enclosed body trucks (packers, front-loaders and roll-offs) must not have any holes or leaks in the body. Roll-off containers must have intact screens or panels covering the rear opening.

(4) Drain plugs must be installed in the drainage hole in the hopper of packer trucks.

(5) There must be no leakage of hydraulic fluid, motor oil, or liquid from refuse onto the road.

(6) Trucks must have intact mufflers and exhaust pipes. Trucks without mufflers or with holes in the muffler or exhaust pipe will not pass.

To investigate the feasibility of incorporating noise as an element into the annual inspection process, a pilot noise inspection program was developed and tested in conjunction with this year's inspection.

The program consisted of an on-site noise inspection of randomly selected refuse collection vehicles, and utilized the recommended methodology contained in the proposed Noise Emission Standards for New Truck-Mounted Solid Waste Compactors, published by the U.S. Environmental Protection Agency on August 26, 1977. This methodology was followed as closely as possible and every attempt was made to meet all of the necessary conditions and requirements.

Through a preliminary statistical analysis, it was determined that 84 trucks should be tested in order to ensure a 95% confidence level. Factors considered in the determination of the sample size included the total number of compactors in the fleet and compactor types.

In order to evaluate the nature of the refuse collection truck noise problem, a noise survey form was developed. Information required included: age, type of compactor and truck, noise measurements, location and hours of operation of the truck. Most of this information could not be recorded on the standard vehicle inspection forms used by the health officer. A sample survey form is shown in Appendix IV along with a copy of the short letter which was given to each driver before the truck was inspected for noise.

The test site conformed to the requirements of the proposed regulations in most respects though it was not ideal. It consisted of a paved parking lot adjacent to the landfill access road, however, the paved portion was small and much of the inspection site was unpaved, though flat. The required distance from truck to microphon was maintained by simply measuring it with a 23-foot long piece of string before each truck was tested.

The trucks to be tested were randomly chosen by simply flagging them down on their return trip from the landfill face. Many were tested for noise immediately after being inspected for their "dump tag" inasmuch as the rest site was located directly across the road from the area being used to inspect the trucks. Care was taken not to test the same truck twice.

The actual noise testing was conducted using the test procedure outlined in the proposed regulations. The compactors were run through two complete cycles with the maximum sound level and peak impacts recorded at four microphone locations and the sound level meters set for "fast response" and "A-weighting." The one exception to this occurred when the two readings differed by 2 dB, and further readings were impossible to take due to factors which will be discussed later.

Upon completion of the noise measurement process, the four-location energy average for each of the two measurement data categories was computed according to the equation set forth in the proposed regulations. It was determined through this process that the median age for all of the trucks in the sample was four years, while the median sound level recorded was 82 dBA.

Out of a total of 84 trucks surveyed, 83 provided the minimum data needed to conduct the survey. Sixty-seven (67) trucks or 80.7% of all the trucks surveyed were louder than the 78 dBA standard proposed for 1979. Of the 67 trucks found to be in excess of the proposed standard, 55.2% were rear packers, 32.8% were front-end loaders, 4.5% side packers, 6.0% roll-offs, 1.5% open dump trucks. The latter two categories will not be affected by the proposed regulations due to the fact that they don't have compacting units, but these comprised a very small segment.

Table I shows the age of each compactor unit on each truck found to be in excess of the proposed standard.

Table I

Cross-Tabulation of Age of Truck Type

Type	Age of Compactor in Years 0-1	2-5	5-10	Over 10	Total Trucks
Rear Packer	7 (19%)	20 (54.1%)	8 (21.6%)	2 (5.4%)	37
Front-End Loader	7 (31.8%)	8 (36.4%)	7 (31.8%)	0	22
Side Packer	0	1 (33.3%)	2 (66.7%)	0	3
Roll-Off	N/A				4
Open Dump Truck	N/A				1
Total Trucks	14	29	17	2	67

Table II is a cross-tabulation of the percent of time the truck is in operation between the hours of 10:00 p.m. and 7:00 a.m. and the percent of time spent picking up non-residential garbage for the 67 trucks in excess of the proposed standard. Due to insufficient data, four samples had to be dropped from this analysis, leaving a total of 63 trucks.

Table II

Cross-Tabulation of Percent Non-Residential Operation and Percent Operation Between 10 p.m. and 7 a.m.

Percent Operation Between 10 pm & 7 am	Percent Non-residential Pick-up 0-10	10-25	25-50	Over 50	Total Trucks
0-5	21	0	2	12	35
5-10	7	0	1	6	14
10-25	2	0	2	4	8
25-50	2	0	0	1	3
Over 50	1	0	0	2	3
Total Trucks	33	0	5	25	63

From this table it can be determined that of the total of the 63 trucks in excess of the proposed standard, 33 (54%) of them operate 3/4 of the time in residential areas. In this group of 33, only three trucks (10%) operate more than 25% of the time between the hours of 10 p.m. and 7 a.m., which indicates that in residential areas, the problem of odd hours of operation is not serious.

In conducting the pilot noise inspection program in conjunction with the annual refuse collection vehicle inspection, a number of problems were encountered in attempting to apply the proposed regulations. Many of these problems may prove to be common to any jurisdiction which endeavors to enforce the regulations, if and when they are approved.

The most difficult problem was securing the necessary instruments and personnel. Prince George's County owns one Type I sound level meter, therefore, three more were borrowed from a vendor, the Maryland State Police and EPA, through the Council of Governments. A barometer, tachometer and anemometer proved to be unobtainable. A simple and inaccurate wind guage was used but the barometric pressure was not considered in the analysis.

In terms of personnel, since the County has only two staff members who work part-time in noise, it was imperative that personnel be "borrowed" from other divisions in the Directorate of Environmental Health to assist in conducting the noise tests. Each one had to be trained in the use of a Type I sound level meter. Inasmuch as the

pilot noise inspection program required several days to complete, enough staff had to be recruited so that no one person would be at the landfill every day. This was a difficult task and it was made even more complicated by the weather. Out of the original five days' scheduled, two were rained out, leaving only three to finish the pilot noise inspection program. Time constraints were now imposed on the program as well.

The test procedure was also hampered by other factors. It was difficult to maintain a 50-foot clear distance behind at least one of the microphones due to an encroachment of other activities into the space. As a result of the proximity of the landfill access road and the landfill itself to the test site, the sound levels produced by the test compactor were not always 10 dB greater than the background level produced by other trucks and equipment. Some accuracy in measurement was sacrificed for two other reasons: (1) in most cases, the operator had to stand between the truck and the microphones in order to operate the compactor, thereby creating a reflecting surface, and (2) there were observers within two feet of every meter, especially the two that were hand held.

The time constraints mentioned above affected the way in which the testing was conducted in that there was no time for taking extra measurements in the event of too much background noise, too much wind, or more than a 2 dB difference between the two sets of measurements for each truck. The staff had no authority to stop trucks and subject them to the noise test, thus participation was voluntary. Most of the truck drivers were anxious to complete their routes and

quit for the day. This made them reluctant to cooperate with the staff and at times there were definite communication gaps between the drivers and the staff. Though the driver's read the letter, discussing the program, most of them simply had no idea what was happening; there were a few instances of open hostility.

In follow-up activities after the pilot inspection program, the noise staff initiated personal discussions with owners of all trucks who participated in the pilot inspection program. There were approximately 35 companies associated with the 80 trucks. The purpose of these discussions was to provide information about the proposed federal regulations, to obtain route data and to suggest maintenance/collection practices which would reduce noise.

In some instances, it was not possible to obtain specific route data. In other cases, secondary sources were used when the original data provided seemed unreliable. This was a very time-consuming process. Staff then researched zoning along the routes and provided suggestions regarding the use of quieter trucks along the residentially zoned routes. In addition, information regarding maintenance was offered.

The pilot inspection program resulted in national news coverage and several inquiries for results of the study.

A local jurisdiction may wish to consider conducting a pilot noise inspection program similar to what has been described in Prince

George's County. A series of suggested steps to be incorporated into the planning process, which will aid in the organization and implementation of the project, are listed below:

(1) Become familiar with the proposed regulations (Noise Emission Standards for Truck-Mounted Solid Waste Compactors), and associated noise testing methodology;

(2) Determine the feasibility of undertaking this project given available resources, and the likelihood of obtaining more resources;

(3) Select the time and place for the pilot noise inspection program, paying particular attention to the location. It is preferable to select a site which is paved (at least 125 feet across in any direction), as level as possible and free of any obstructions such as poles, signs, rocks, gravel and walls;

(4) Secure the necessary personnel and instrumentation well in advance. This is important in jurisdictions with small noise control staffs and little or no instrumentation. It may be necessary to borrow the required instrumentation from various sources and conduct a training session in the use of the instruments

for personnel who may not be familiar with their use. The most important pieces of equipment are: (1) four, Type I sound level meter sets with detachable microphones, (2) tripods and (3) extra cable. The Type I meters must meet the requirements of, and be certified by, the American National Standards Institute (ANSI). It is helpful if the meters are equipped with a "max hold" capability;

(5) Perform a statistical analysis to determine the number of collection vehicles it will be necessary to test (and the different types of vehicles) in order to achieve a certain confidence level in the results; and

(6) Contact the refuse collection companies in advance to encourage their participation and cooperation. Assure the collectors that you are not trying to "shaft" them in some way, an idea which may lead to an unhealthy climate.

Finally, a local jurisdiction may wish to conduct an attitudinal survey to determine whether noise from refuse collection vehicles is considered a problem in the area, and whether the local citizenry want to see something done about it.

The noise staff interviewed residents whose homes were in close proximity to collection points for trucks owned by the County Board of Education. When no one in adjacent homes was available, the staff noted observations regarding possible problems.

V. Exploration of Probable Impact of Taking no Local Action and Allowing Federal Regulation to Serve as Only Control:

Evaluation of this alternative was approached in two different ways. First, the data available on the entire fleet of refuse collection vehicles in the County was used for prediction purposes. Then, the more recent data compiled in the pilot noise inspection survey conducted in May was analyzed.

In the total fleet, there are approximately 740 refuse collection vehicles. The average age of the vehicles was 5.7 $\pm$ 3.3 years. At the time the data were collected, the average year of make was 1970. If all trucks are replaced when the average age is achieved, then 5.7 years after the regulations go into effect (late 1984), all compactor-trucks should be post-regulation, quieter trucks. Taking into account deviation from the standard lifespan (unreplaced equipment which is older than average), it can be said that with 67.5% confidence, all trucks will be replaced by quieter ones by 1988, with 95% confidence, all trucks will be replaced by 1991, and with 98% confidence, all trucks will be replaced by 1995, always assuming that the average age or lifespan remains constant at 5.7 $\pm$ 3.3 years.

Since the data collected during the pilot noise inspection program was more current and complete, projections were also calculated from this information. Compactor age and truck age correlated well enough to assume that they are typically replaced as a unit in the County. The average age of vehicles in this sample was 4.3 $\pm$ 2.6 years, and the average model year was 1974. If all trucks are

replaced when the average age is achieved, then 4.3 years after the regulations go into effect (mid-1983), all compactor-trucks should have been replaced by post-regulation, quieter trucks. Taking into account deviation from the standard lifespan (replaced equipment which is older than average), it can be said with 67.5% confidence that all trucks will be replaced by quieter ones by 1986, with 95% confidence that they will be replaced by mid-1988, and with 98% confidence that they will be replaced by 1991. This concurs with an assumption made in the background document for truck-mounted solid waste compactor noise emission standards (EPA 550/9-77-204, p. viii), that there will be 100% turnover of trucks by 1991.

In the background document for EPA's proposed regulations, a formula is provided for the calculation of Equivalent Noise Impact (ENI). The calculation of ENI is explained in Section I of this report. It provides a mechanism for predicting the number of persons who experience general annoyance from truck-mounted compactor noise. Using the formula, it was estimated that approximately 224,970 persons in Prince George's County currently experience general annoyance.

Using population projections for the County in 1991 and assuming a similar mix of residence types, the ENI was calculated for that year when a 100% new fleet of quieted trucks is anticipated. Even with a projected population increase of approximately 160,000 persons, the ENI is reduced from the current level of 224,970 to 181,776 persons experiencing general annoyance in 1991. Thus, it appears

that a significant decrease in general annoyance can be anticipated if the County took no direct action and allowed the federal regulations to serve as the only control mechanism.

However, our experiences and observations during the completion of this study clearly indicate the need for local government participation as well. To maximize the benefit of quieter, new collection vehicles, a mechanism for assuring continued maintenance of the collection vehicles and quiet collection practices is needed. The local government noise enforcement program must have the resources and personnel to provide this vital monitoring function.

VI. Summary and Conclusions:

This investigation of approaches to the control of noise from refuse collection vehicles was a cooperative study by the Division of Solid Waste and Noise Control in Prince George's County and the Metropolitan Washington Council of Governments. The study was funded by the U.S. Environmental Protection Agency, Office of Noise Abatement and Control.

During the investigation, several potential noise control mechanisms were examined. These included: (1) the potential impact of a legislative alternative requiring stationary compactors for all new highrise developments, (2) the effect of a collection curfew, (3) the incorporation of noise into an annual inspection program and (4) the impact of taking no local action and allowing federal regulations to serve as the only control. The purposes of the study were twofold. First, to explore the potential of the control techniques in a large metropolitan jurisdiction and, secondly, to develop a document which would assist other jurisdictions in evaluating the control strategies, based on their local conditions.

The establishment of a legislative requirement for use of stationary compactors in all highrise developments was not found to be a practical approach to noise control in Prince George's County. Although there are economic and health benefits to the use of stationary compactors, conventional collection is still required. In Prince George's County, it is the collection activities which result in noise complaints. Moreover, examination of planned future development

for the County revealed that highrise development is to be minimal. In other jurisdictions where extensive highrise development is anticipated, further consideration of this alternative might be warranted.

In terms of a collection curfew, a survey of haulers indicated that even though evening and early morning pick-up services were provided, the routings were such that there was little impact on residential areas. Moreover, in the few instances of complaints, haulers were most cooperative in making voluntary schedule adjustments. In areas where voluntary adjustments cannot be achieved, a curfew obviously has potential. In jurisdictions where refuse collection is either handled by vehicles owned by the municipality or contracted by the jurisdiction, implementation of a curfew is quite simple. The potential problems are enforcement practices which are equitable and imposing uniform, unnecessary constraints on all haulers. Thus, jurisdictions are encouraged to explore voluntary schedule changes before imposing a mandated curfew.

Of the four alternatives explored, the incorporation of noise into an annual inspection program is, undoubtedly, the preferred mechanism for control. Although it is somewhat labor intensive, it provides a mechanism for routine monitoring and isolation of particularly noisy vehicles. It also is a perfect compliment to the proposed federal regulations. The license issued at the time of annual inspection can be revoked at any time of the year if the vehicle is found in violation. Most jurisdictions already have some

form of inspection program for refuse collection vehicles, thus, noise can be incorporated relatively easy. It also is an ideal time to encourage use of quieter collection vehicles in residential areas and to remind haulers of the importance of quiet collection practices.

The final alternative, allowing proposed federal regulations to serve as the only control, would in time reduce general annoyance. However, the investigators have concluded that local control, through inspection and monitoring, must be continued for maximum benefit.